PRE-DISASTER

FLOOD HAZARD MITIGATION PLAN

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Preface

There will continue to be flood disasters in South Dakota in the future. Their impact will depend largely upon where floods occur. In areas of large urban population, the potential for damage is generally greater than in less populated rural areas.

The Federal Emergency Management Agency (FEMA), the State of South Dakota, it's Division of Emergency Management (SDDEM), and other State Agencies and organizations have responded to disasters, providing assistance to people in terms of food, shelter, clothing and restoration of public and private facilities. Since these efforts are vitally important, they will continue.

If we do no more than respond to disasters, the problems can return and we will not have learned from our mistakes. Mitigation means that we are going to learn from past mistakes and that they won't be repeated in the future. FEMA's newly created Flood Mitigation Assistance Program (FMA) will go a long ways to accomplishing just that. The program fund will assist communities in the development of Pre-Disaster Flood Hazard Mitigation Plans. This planning effort will focus on strategies, approaches, actions and recommendations for projects that, when implemented, will eliminate or reduce future flood losses. Long range planning is one of the key ways to break the disaster-recovery-disaster cycle. It will insure that a South Dakota community, who has implemented pre-disaster flood mitigation measures, will be able to withstand the effects of economic distress, endangerment to life and environmental degradation experienced in disaster situations.

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1. Floodplain Management

A comprehensive floodplain management program is necessary for the long-term success of a community's flood mitigation strategy. Floodplain management is a continuous decision making process involving the wise use of identified floodplains in the community.
It encompasses:

- the choices made by homeowners and businesses in floodplain areas.
- decision making of officials at all levels of government,
- development plans made by owners of commercial floodprone land, and
- the judgements of farmers and ranchers with pastures and fields bordering riverbanks.

The success of floodplain management at any scale depends on the collection and utilization of engineering and administrative information. The process of floodplain management draws upon

such information to improve sound decision-making for the future use to be made of identified floodplains. Effective management requires prompt but wise decision making compatible with the risks and resources inherent to floodplains. If decisions are not made wisely, development and other non-conforming uses may prove unacceptable and costly. Proper floodplain management promotes activities on floodplains compatible with the risks to human life and property.

2. Purpose

This document is a model pre-disaster flood hazard mitigation plan. It can be used by South Dakota communities in the development of a mitigation plan for their jurisdiction. Once the plan is adopted and approved by FEMA, it can be used as the support document to accompany mitigation funding requests required under the Flood Mitigation Assistance Program (FMAP). Other funding programs that seek to reduce flood losses and protect and improve the natural environment also require similar planning documents.

Model
Local Pre-Disaster Flood Hazard Mitigation Plan

1. Introduction

In recent years, Floodville, Colorado has grown very fast. This growth has included the paving of undeveloped land areas with parking lots, subdivisions, etc. These activities have increased overland run-off in the community by reducing the amount of area where heavy rainfall can be absorbed by the soil. In the past 3-5 years, heavy summer thunderstorm events have caused the two creeks in the community to flow at higher levels than any of the citizens can remember. In the summer of 1994, a flood event caused minor damage to three roads and two bridges and forced the temporary evacuation of several homes in Floodville. The City Council contacted the Colorado Water Conservation Board and the Colorado Office of Emergency Management (OEM) immediately after that flood to seek advice. Both agencies recommended the development of a local Flood Hazard Mitigation Plan. This document is the result of the subsequent planning effort.

The purpose of this Pre-Disaster Flood Hazard Mitigation Plan is to 1) identify the critical flood hazard issues for the city and surrounding area, and 2) identify pre-disaster mitigation activities and techniques that can be implemented to reduce future flood losses before they occur. The Colorado Water Conservation Board has developed this model Pre-Disaster Flood Hazard Mitigation Plan for Colorado's communities with support from local, county, state and federal personnel.

2. Community Description

Floodville is located in central Jefferson County at the mouth of the Big Whopper Canyon. Floodville entered the Regular Phase of the National Flood Insurance Program (NFIP) on December 19, 1983. Its Flood Insurance Rate Map (FIRM) was revised on November 23, 1988 as the result of a restudy by FEMA. Streams in the community which have the 100-year floodplain delineated by detailed engineering methods are High Ball Creek and Risky Creek. One other floodplain study exists for the community. It was prepared by Langster Engineering, Inc. on January 22, 1990. It contains updated detailed floodplain information based on new topographic information and new hydrology for Risky Creek, only.

3. Past Flood Hazard Mitigation Activities

Flood hazard mitigation activities can be undertaken before, during or after a flood event. This plan focuses on pre-disaster flood hazard mitigation activities which, when implemented in Floodville, will reduce future flood damages. First however, Floodville's past mitigation activities will be described to demonstrate the community's ongoing commitment to the reduction of flood damages whenever funding permits. Past and future mitigation activities will be characterized into two broad categories: 1 - Non-structural flood hazard mitigation, 2 - Structural flood hazard mitigation. Examples are as follows:

Non-Structural	Structural
Flood insurance	Levees
Floodplain regulations	Channel improvements
Acquisition and relocation	Retrofitting of floodprone buildings
Open space policies	

The CWCB encourages Colorado's floodprone communities to seek the implementation of non-structural flood hazard mitigation activities wherever feasible. However, we realize that many times structural activities are the only viable options a community may have because of local circumstances.

A. Non-Structural Flood Hazard Mitigation in Floodville

1. Flood Insurance

There are three types of insurance one should investigate in order to reduce uninsured losses from floods.

National Flood Insurance Program: This is a federally-subsidized program that is available to any property owner in a participating community whether or not the structure is located in an identified flood hazard area on a community's FIRM. Insurance is sold through private insurance agents. Floodville is a participant in good standing in the NFIP.

Sewer Backup Insurance: This will cover water damage to a structure and contents when sewer lines back up. It is a commercial insurance policy and details will vary from company to company.

Sump Pump Insurance: Several companies will insure for damages caused if a sump fails. Check several companies to see if they carry it and what the policy covers.

More about the NFIP: The NFIP is based on an agreement between local Colorado communities and the federal government. The community agrees to implement measures to reduce future flood risk to new construction and substantial improvements in identified Special Flood Hazard Areas as mapped by FEMA on a community's Flood Insurance Rate Map (FIRM). Then, FEMA makes flood insurance available within the community as a financial protection against flood losses when they occur. The insurance is designed to provide an alternative to disaster assistance to meet the escalating costs associated with the repair of structures and replacement of contents when damaged by a flood event. Until the establishment of the NFIP in 1968, flood insurance was generally unavailable from private sector insurance companies.

Flood insurance claims information indicates that 35-40% of all NFIP claims come from outside the 100-year floodplain. The 100-year floodplain, as delineated on the community's FIRM, is the area which the community has agreed to regulate in exchange for flood insurance availability in the community.

2. Open Space Policies

The Floodville City Council, on March 3, 1995, adopted a new provision to the city's code as follows:

"Floodplain lands and adjacent waters combine to form a complex, dynamic physical and biological system that supports a multitude of water resources, living resources and societal resources. Floodplains provide Floodville with natural flood and erosion control, water-filtering

processes, and a wide variety of habitats for flora and fauna, places for recreation and scientific study and historic and archeological sites. They are also the locus of a variety of human activities, including commerce, agriculture, residence and infrastructure. It is the policy of the City of Floodville to preserve these natural and beneficial values of floodplains through conscious land use decision making that encourages open space uses in floodplain areas."

3. Acquisition and Relocation
In 1985 under FEMA's 1462 Program, Floodville acquired and relocated two (2) repeatedly flood damaged structures in the High Ball Creek floodplain located inside the creek's levee system. Though a costly proposition at the time, it has been a prudent move since this area of the floodplain has been flooded twice from relatively average thunderstorms since the relocation was accomplished.

4. Floodplain Regulations
Upon entrance into the NFIP, Floodville adopted the minimum standards of the program. Since detailed mapping, with floodways, had been prepared for the community, FEMA's "D" model ordinance was adopted. The regulations set the performance standards by which development can occur in the community's identified floodplains. Floodville exceeds the NFIP's minimum standards in one respect. All new residential development must be constructed one (1) foot above the level of the 100-year flood.

B. Structural Flood Hazard Mitigation in Floodville

1. Levees
Following the flood of 1957, the U.S. Army Corps of Engineers constructed a levee system on High Ball Creek for its entire length through Floodville. Since 1957, the levee system has protected about half of Floodville from its most damaging floods.

2. Channel Improvements
Risky Creek has had channel improvements in conjunction with a large subdivision. Channel banks were stabilized with gabions in a reach 570 feet long on both sides of the stream. City officials required the improvements under the community's subdivision regulations in lieu of a park area, which was the preferred and recommended mitigation strategy.

3. Retrofitting of Floodprone Buildings
Floodville's downtown business area sits at the confluence of High Ball and Risky Creeks. Glass block windows have replaced conventional windows at ground level in twelve businesses.

4. Current Problem/Issue Identification

A. Flood Hazard Inventory

The first step in the flood hazard inventory process is to define the flood hazard. To undertake this process, one should review the flood history of Floodville. One important area of focus of the Flood Mitigation Assistance Program (FMAP) will be repetitive loss areas. The local pre-disaster flood hazard mitigation plan should focus on such areas because of the often-disproportionate amount of flood damage, which occurs here.

History of Flooding
Flooding from streams in Floodville usually occurs during June through August, with the principal cause of flood flows being thunderstorms. The community is known to have a long history of flooding, the earliest occurring in 1888 (Reference 4). The flood of June 30 - July 1, 1917 is considered the most severe in the Floodville area, with an estimated peak discharge of 7,120 cfs on High Ball Creek. The largest flood on Risky Creek occurred in 1921, with an estimated peak flow of 1,235 cfs. The largest discharge recorded on High Ball Creek was on July 21, 1957, with a peak of 6,800 cubic feet per second (cfs). General rains lasting up to five days in mid-June 1965 caused significant flooding with discharges on High Ball and Risky Creeks of 5,775 cfs and 975 cfs, respectively. In 1973, large snow depths in the South Platte River basin resulted in unusually high snowmelt flows. In 1992, a long lasting, intense thunderstorm caused moderate flooding on Risky and High Ball Creeks with discharges of 720 cfs and 3,440 cfs, respectively.

An U.S. Army Corps of Engineers report (Reference 3) describes the 1957 flood as follows:
Floods on High Ball Creek on July 21, 1957 had an instantaneous peak discharge of 6,800 cfs at the High Crest gage. This flood was the maximum of 52 years of record, and its magnitude had an estimated frequency of occurrence of once in approximately 70 years (a 70-year flood).

The creek in the problem area is characterized by low banks, braided channels and a considerable amount of gravel, cobbles and snags deposited on gravel bars.

The creek carries a large bedload of gravel and cobbles, some of the latter being more than 6 inches in diameter. The capacity of the channel has been reduced by this sediment. In some instances, where channel changes took place during the flood, the original channels were so filled with sediment that nearly all of the present flows are discharging through the new channels. However, the new channels are the old watercourse, which was abandoned by the river during previous flood events. The littered condition of the channels and the increased danger of bank erosion, inundation, and resulting channel changes constitute the present flood problem.

More than one-half of the known damages in the 1957 flood were caused to roads and bridges in the area, with nearly $24,000 of damages being caused to three (3) bridges and their abutments.

Table 1 - Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
High Ball Creek downstream of Hwy 77	254	5,550	6,375	8,800	9,150
above confluence with Risky Creek	224	5,025	5,975	8,375	8,890
Risky Creek at confluence with High Ball C.	27	850	1,100	1,350	2,300

After several decades of work and dollar investments to address flood problems in Floodville, the immediate threat to human life has stabilized. Other flood losses (public and private property damage, injuries, disruption and disaster relief) continue to rise, and the natural resources provided by floodplains are still being degraded. These two phenomena are due to the ever-increasing pressure by developers to construct residences and businesses in the floodplain. Aesthetic and serene river views are a main selling point for many prospective buyers. The risk of developing in these areas still remains and the development itself reduces the aesthetic appeal and serenity of Floodville's stream corridors.

The main area of concern in Floodville is the 100-year floodplain at the confluence of High Ball and Risky Creeks. As it happens, the community's downtown business district is located in this area. Most of the structures in this area have basements, which were constructed before the community entered the NFIP. If structural and non-structural mitigation activities can be implemented it will ultimately reduce flood losses.

B. Flood Hazard Areas

The next step in defining the problem is to clearly identify the areas affected. One should review mapping of the flood hazard areas, collect additional flood hazard data, and identify other hazards which affect the area.

1. Planning Maps

Flood hazard areas are most often displayed on maps. The latest Flood Insurance Rate Map for Floodville was issued by FEMA on November 23, 1988. Copies of the map can be used and marked up as part of the planning process to develop the local Pre-Disaster Flood Hazard Mitigation Plan.

2. Unmapped Flooding

Flooding may include more than just overbank flooding from local streams and lakes. If people get wet from "stormwater" flooding, they expect the community to address it. The problem description should include a discussion of flooding from other sources, which may or may not be "unmapped". If possible, the plan should include these problem areas on the community's "work map".

3. Flood Hazard Data

Not only should the location of flooding be determined but also the severity of flooding should be described as follows:

a. ***Sources of Water:*** The names of rivers and lakes should be included as well as the other sources of local drainage, ponding and stormwater runoff.

b. ***Depth of Flooding:*** No flood hazard area can be considered safe. However, flooding over three feet is more hazardous. Areas subject to such depths should be identified by comparing base flood elevations with ground elevations.

c. ***Velocities:*** Flood water velocities over 5 feet per second are most hazardous especially when combined with deep flooding. Since velocity data is often hard to obtain and it can include inaccuracies, the following rule of thumb should be used for planning purposes: 1) One foot deep - no vehicles; and 2) three feet deep - no people.

d. ***Warning Time:*** Warning time of as little as 30 minutes can be enough to implement property protection measures. State, county or local emergency managers should be contacted to obtain these times so they may be incorporated into the plan.

e. ***Repetitive Loss Areas:*** Repetitive losses account for 1/3 of all NFIP flood insurance claims. Areas of repetitive loss should be identified. Such information can be obtained from FEMA's Regional Offices in Denver at (303) 235-4830.

4. Problem Assessment

A systematic inventory of everything located in the flood hazard area is needed to insure that all potential problems are addressed in the Local Pre-Disaster Flood Hazard Mitigation Plan. Development trends and development constraints should be included in the plan. Because of map inaccuracies, areas near the flood hazard area should be looked at closely as well.

a. ***Land Use and Buildings:*** An inventory should describe how the community's flood hazard areas have been developed and how many building are affected. Community land use maps can be helpful in identifying these areas. ***A count of the buildings affected by flooding is essential.*** Windshield surveys or aerial photos can be used to accomplish this task. Any flood damage data for buildings, which is available from previous flood events, will be helpful to assist in project prioritization.

b. ***Critical Facilities:*** A critical facility is a building or site that would constitute a major impact to the community if flooded. Basically there are two types: First, facilities that will increase the hazard if flooded, such as a hazardous materials storage site; and second, facilities that are vital to the flood fighting effort such as the community's emergency operations center. Roads and bridges can also be considered critical if they would prevent emergency vehicles from accessing threatened areas. Water and sewage treatment plants should be included in this category.

c. ***Natural Areas:*** Flood hazard areas often contain wetland and undeveloped areas, which carry the majority of floodwaters and provide "natural and beneficial functions". Most often, attention is focused on existing structures and infrastructure such as power substations and water lines during a flood event. However, many of these natural areas are irreplaceable. Preserving their functions pays off in the long run. Not developing them may actually increase property values. An inventory of these areas is an important part of the community's plan. The EPA and U.S. Army Corps of Engineers are two agencies where such information can be obtained.

d. ***Future Development:*** The plan needs to look at present day conditions and development potential of vacant land. Zoning, building and subdivision regulations usually have the greatest impact on development trends. The local planning process needs to consider whether current community regulations are appropriate for the types of expected development. Development trends can be used to determine what is likely to be in the floodplain in the future.

e. ***Problem Statement:*** The culmination of the hazard inventory and the problem assessment is a written problem statement. It summarizes the hazard and identifies the most hazardous areas. The community's floodplain map with hazard data is essential. The problem statement should address all areas of concern including buildings, critical areas, etc. Then, the problem statement should be prioritized. This may be based on areas with greatest numbers of buildings at risk, as with deepest flood depths, and flows with highest velocities, and so on. The problem statement is a summary of the impact of the hazard on the community. Since all problems can't be addressed at once, areas or issues of concern need to be prioritized. An example is:

a. *The base flood on Hugh Ball Creek affects 150 homes, 12 businesses. This is the area mapped as the "A Zone" on the Flood Insurance Rate Map.*

b. *Repetitive flooding on Risky Creek affects 22 homes in the Riverside Subdivision. This area faces the greatest threat and most frequent damage from flooding and is designated Priority Area #1.*

c. *Critical facilities in the High Ball Creek floodplain are the Community Hospital, the wastewater treatment plant, Front Street and Colorado Hwy 119. While flooded only once during the last 50 years, the impact of flooding on the wastewater treatment plant is so great that it is designated as Priority Area #2.*

d. *The Riverview Shopping Center was built in a depression and floods on the average of once a year during heavy rains, resulting in damage to inventories and parked cars, lost business and a threat to public health. It is designated as Priority Area #3.*

e. *The most hazardous floodprone area is the floodway of the mainstream of High Ball Creek downstream of County Road 55. The area is vacant but subject to development when the interchange between C.R. 55 and the interstate is built.*

f. *The Risky Creek Woods bottomlands are a unique local asset that should be preserved and protected.*

g. *Sewer backup and poor local drainage is a problem for buildings with basements and split level homes throughout town.*

h. *Flooding and stormwater problems can be expected to worsen if current watershed development practices continue.*

5. Future Flood Hazard Mitigation Activities

There are five basic mitigation strategies: Prevention, Property Protection, Emergency Services, Flood Control, and Post Flood Activities.

Each strategy has different measures that are appropriate for different conditions as follows:

Preventive Mitigation Measures:
Planning, acquiring, or regulating the development or land use to keep problems from getting worse. The building, zoning, planning or code enforcement offices usually administer preventive measures.

Property Protection Mitigation Measures:
Protecting individual buildings or properties from flood damage. Property protection measures are usually the responsibility of property owners, although government agencies can provide information and technical or financial assistance to the owners.

Emergency Services Mitigation Measures:
Measures that are taken during a flood to minimize the impact. These measures are the responsibility of emergency management staff and the owners or operators of critical facilities.

Flood Control Mitigation Measures:
Keeping floodwaters away from an area. Flood control activities are usually designed by engineers and managed by public works staff. There are basically two types: structural and non-structural. A community's Pre-Disaster Flood Hazard Mitigation Plan should focus on both.

Post Flood Mitigation Measures:
Long-term and sustained measures/activities that are taken following a flood to eliminate or reduce future flood damages. These measures are the responsibility of local officials and staff, private citizens and various state and federal funding agencies.

6. Proposed Mitigation Activities for Floodville

The activities listed below are those for which Floodville seeks funding from FEMA's Flood Mitigation Assistance Program (FMA) as well as other funding sources. When implemented, they should almost totally reduce the community's flood hazard vulnerability. In addition, the natural and beneficial values of floodplains in the community will be preserved and enhanced.

A. Non-Structural Flood Hazard Mitigation

1. Creation of Wetlands and the Wetland Banking Program

As an integral part of Floodville's Pre-Disaster Flood Hazard Mitigation Plan, wetlands within floodplain areas will be created. Their creation will constitute a "bank". The wetlands will be similar to "new funds". When and if, wetlands are impacted outside the 100-year floodplain due to development, these "new funds" can be used as payments for the loss.

2. Flood Insurance

Through an improved education and promotional program with local insurance agents and lenders, Floodville proposes to increase its flood insurance policy base by 10 percent a year for the next 5 years. Current coverage is 17% of all structures in the 100-year floodplain in the community. Workshops for lenders and agents will be intensified in the community. Community officials will provide local lenders addresses and owners names located in the identified 100-year floodplain. Following the workshop, floodplain residents will be invited to a "town meeting". The advantages of purchasing flood insurance will be presented as well as retrofitting techniques, which can be undertaken by individuals to reduce future flood losses.

3. Acquisition and Relocation

Acquisition is a mitigation technique whereby floodprone properties are acquired/purchased by an entity (usually governmental) and removed from the site. The property is then usually left as open space in perpetuity. Relocation is a mitigation technique whereby floodprone properties are moved out of the flood hazard area to a safe location and the site is left as open space.

One older residential neighborhood in Floodville is designated as low to moderate income housing by the Colorado Division of Housing. The neighborhood contains twelve homes constructed on concrete slab foundations. All are subject to flooding from High Ball Creek with 100-year flood depths ranging from 3 to 6 feet.

When funding is available, Floodville plans to acquire the 12 homes and move them to a non-floodprone location, which the community presently owns. Once this action has been completed, Floodville will designate the area as open space by City Council resolution. In addition, a deed restriction will be placed on the property to assure that open space will be the use of the property in perpetuity.

B. Structural Flood Hazard Mitigation

1. Retrofitting of Floodprone Buildings

Floodville plans to replace all conventional ground level windows in downtown residences and businesses with 4-inch glass blocks. Doorway entrances to lower floors will be protected by concrete block floodwalls one foot higher than the base flood elevation at each location. These entrances will require persons to step up before descending.

Floodville seeks $_____in MAP funding to implement the structural and non-structural flood hazard mitigation measures described above. Upon receipt of full funding, completion of all activities, except increasing the flood insurance policy base, will be accomplished in 18 months.

7. Coordination

A. Why Coordinate?

Experience has shown that mitigation plans get implemented when flood concerns are allied with other community needs and goals and other agency's programs. Coordination insures that mitigation activities do not conflict with others' plans for an area. Coordination also facilitates the sharing of limited funds and resources to accomplish goals in the plan. There are usually citizens who want more and better parks in the community. Such funding programs for these activities might be used to pick up the cost of acquiring floodprone structures in a community's flood hazard areas when parks are proposed for these areas. Coordination also helps maintain waning interest in projects that may take a long time to accomplish. Lastly, funding programs may require applicants to have their programs coordinated with other agencies. Often, other sources of funding must be exhausted before other program funding can "kick in". Both of these needs can be met through coordination among all parties.

B. Community Needs and Goals

A flood hazard mitigation plan must be consistent with, and even supported by, other plans for the community. Flood hazard mitigation planning should be integrated into existing planning efforts so that flood issues are incorporated into a community planning staff's regular duties.

C. Other Resource Agencies

There are many agencies, which can impact future activities in a community's flood hazard area. A planner or community official needs to contact these agencies during the hazard inventory and problem assessment phase of plan development. This will determine if they have information that can help the planning effort and see if they are interested in participating in the effort.

Coordination with other agencies can be combined with technical assistance. For example, during the discussions on emergency services, the planner can invite the National Weather Service (NWS) to the committee meeting. The NWS can advise the planners about flood warning and who can help establish the system. At the same time, the planner can advise the NWS about the local flood situation and see if there are any plans for installing warning gages in the area.

D. Review Mitigation Measures

As part of the planning process, all proposed activities should be examined. The simple and inexpensive mitigation measures should be implemented as soon as possible.

8. Public Input

A. Public Input Workshop

Public officials concerns about flooding and mitigation don't always mesh with the concerns of private citizens. The concerns of citizens must be incorporated into the Pre-Disaster Flood Hazard Mitigation Plan. This method embodies the "bottom-up partnership" approach to floodplain planning. This process begins with a facilitated workshop that can sometimes last more than one day or one meeting. The workshop can involve as many as 50 people representing residents, business interests, public interest organizations and local and regional governmental agencies. The workshop agenda includes both the identification of the flood problem and assembling ideas for solving it. In the process, other community needs and goals are discussed and incorporated.

B. Public Meetings

Only a few of the affected residents may be able to participate on a planning committee that meets for more than one day. It is important to let all citizens have an opportunity to review and comment on the draft plan. Therefore, a public meeting is recommended even when there is a planning committee that incorporates public involvement.

The public needs adequate notice and information about the plan well before the public meeting. A legal notice on the front page of the community newspaper is good. However, notices sent to individual floodplain residents are better. People should also be notified where they can obtain a copy of the draft plan before the public meeting. At least one public meeting to obtain public input should be held two weeks prior to submittal of the recommended plan to the community's governing body.

9. Action Plan

A. Select Appropriate Measures

Some measures will fall out during the planning process. They will be obvious and easy to implement. However, the plan should still systematically review each proposed flood mitigation measure and discard it only after the following questions are answered in the negative:

Is the measure technically appropriate for the hazard?
Is the measure appropriate for the community's needs and goals?
Is the measure affordable?
Are the measure's benefits worth the cost of the measure?
(In other words, will a community derive one dollar or more in benefit for every dollar it spends on a mitigation activity or project?)
Will the measure comply with all local, state and federal regulations?
Does the measure have a beneficial or neutral impact on the environment?

B. Drafting the Plan

The plan can be presented in any format. At a minimum, three items should be included: 1) a description of how the plan was prepared, 2) recommendations, and 3) a budget.

Example Plan Organization

1. Introduction

2. Flood Hazard Inventory
3. Flood Problem Assessment
4. Preventive Mitigation Measures
5. Property Protection Measures
6. Flood Control Measures
7. Emergency Services Measures
8. Post-Flood Measures
9. Action Plan

A description of how the plan was prepared is needed because FEMA recognition of the plan is dependent on the planning process. The NFIP Reform Act specifically states that there shall be a planning process to develop a pre-disaster flood hazard mitigation plan. Monetary assistance from the Flood Mitigation Assistance Program is contingent upon development of a plan that had a planning process component with public involvement. When selecting the appropriate mitigation measures, it should be determined 1) what will be done, 2) by whom, 3) by when, and 4) how it will be financed. The result will be a list of projects, project assignments, as specific as possible.

C. Budget

The plan should determine how recommendations would be financed. Financial feasibility is essential. Generally there are four sources of funding for recommended projects:

1- Operating Funds
2- Line item appropriations
3- Bond issues
4- Outside funding

D. Post Flood Activities

A pre-flood plan should include a section that addresses post-flood operations and activities. In reality, any post-flood activity can be considered a pre-flood mitigation measure because it is being conducted in preparation for the next flood event. Post-disaster procedures should be discussed with appropriate emergency response staff before completion. Two items need to be included in the post-disaster section: responsibilities for post-flood mitigation activities, and identification of post-flood mitigation opportunities.

E. Circulating The Draft

The draft action plan should be publicized and circulated among affected entities such as state and federal agencies, neighboring communities and other departments in community government. Written concurrence of community agency heads should be secured.

The draft should be made available for review by affected citizens and businesses. The public meeting part of the review process should occur no sooner than two weeks after citizens have had a chance to perform their review. After the meeting, appropriate changes should be made and submitted to the community's governing body for adoption.

F. Adoption

The recommendations usually involve more than one department in the community. Therefore, the plan needs to be adopted by the community's governing body. The resolution to adopt the plan should contain the following:

Official adoption of the plan and its recommendations,
Designation of someone who will insure plan implementation,
Designation of priority recommendations, and
Proviso for implementation progress reports.

G. Implementation and Evaluation

The community's resolution, which adopts the plan, should identify one individual with overall responsibility for implementation of the program. Persons involved in the implementation of the program should definitely be involved in the planning process. Inexpensive but locally visible projects should be implemented quickly so the public sees that the community is doing something. A monitoring system of program implementation should also be set up so persons don't forget their assignments.

As a plan is implemented it should be periodically evaluated. It may be determined after a time that the public works department would better accomplish a certain activity than the engineering department. Such changes need the appropriate approval from the community's governing body.

H. Responding to Opportunities

A community should always be ready to act quickly to take advantage of opportunities provided by disasters, heightened public interest due to flooding elsewhere or extra year-end money. The Limon tornado on 1990 allowed local government officials to implement regulations, which require elevation of substantially, damaged manufactured homes in a floodplain (one of the affected areas) on permanent foundations. This opportunity would not have presented itself otherwise.

Example Action Plan Recommendations

Recommendation 1: Flood Control Measures

What: Prepare a flood threat recognition system, which uses the State Engineer's Water Talk Network to access current flow data on High Ball and Risky Creeks. Determine at what flow level (cfs) emergency action measures are to be implemented. This can be accomplished by placing a staff gage just downstream of the County Road 361 bridge abutment in Jefferson County and correlating flows from the flood profiles in Floodville's floodplain study.

Depth above streambed:	2.9 feet = 800 cfs (10 year flow)
	3.4 feet = 1140 cfs (50 year flow)
	3.5 feet = 1300 cfs (100 year)

Who: Emergency Manager and Public Works Director in conjunction with the State Engineer's Water Talk Network.

When: Have monitoring system in place by June 14, 1995.

Supporting Agencies: Jefferson County Emergency Management, State Engineer's Office, Colorado Water Conservation Board.

Budget: Town operating funds to be reimbursed from the State's Disaster Assistance Fund, if available.

Recommendation 2: Property Protection Measures

What: Notify town residents of flood threat. Use a news release with 1) snowpack conditions and impending threat, 2) availability of flood insurance, 3) a statement that all protection measures are a) considered temporary, b) need a floodplain development permit, and c) must be removed following the flood threat. If not removed, they must be engineered to comply with the town's floodplain regulations.
Who: Town Manager and Public Works Director.
When: Have news release published in the next issue of the community's newspaper.
Supporting Agencies: Colorado Water Conservation Board.
Budget: Technical assistance from the CWCB and the town's operating budget.

Recommendation 3: Sandbagging Operations

What: Sandbag 1) the water treatment plant intake and 2) three wood headgate structures on ditches that impact the water treatment plant.
Who: Town Public Works Director, County Emergency Manager and volunteer staff.
When: By June 16, 1995.
Supporting Agencies: Colorado Water Conservation Board, Colorado Office of Emergency Management, U.S. Army Corps of Engineers, Omaha District.
Budget: Sandbags from OEM. Sand from county gravel pits. Town's operating budget for coordination efforts of the PW Director.

Recommendation 4: Sandbagging Operations

What: Create a 90 degree turn on High Ball Creek just above the C.R. 350 bridge to protect residences.
Who: Town Public Works Director and volunteer staff.
When: By June 16, 1995.
Supporting Agencies: Colorado Water Conservation Board, Colorado Office of Emergency Management, U.S. Army Corps of Engineers, Omaha District.
Budget: Sandbags from OEM. Sand from county gravel pits. Town's operating budget for coordination efforts of the PW Director.

Recommendation 5: Road Closures

What: Develop road closure plan for when flood inundation occurs.
Who: Town Public Works Director and Jefferson County emergency services staff.
When: By June 16, 1995.
Supporting Agencies: Jefferson County, Colorado Department of Transportation, Colorado Water Conservation Board, Colorado Office of Emergency Management.
Budget: County and town operating to be reimbursed by the State's Disaster Assistance Fund, if available.

Recommendation 6: Keeping Bridge Openings Clear of Debris

What: Develop a snagging and clearing plan for when flood inundation occurs.
Who: Town Public Works Director and Jefferson County emergency services staff.
When: By June 16, 1995.
Supporting Agencies: Jefferson County, Colorado Department of Transportation, Colorado Water Conservation Board, Colorado Office of Emergency Management.

Budget: County and town operating to be reimbursed by the State's Disaster Assistance Fund, if available.

Note: The Town of Floodville should keep track of all expenditures. Accurate financial records will be essential when a community seeks reimbursement for emergency operations.

10. Bibliography and References

1. City and County of Pueblo Flood Hazard Mitigation Plan, Colorado Office of Emergency Management, August 1994.

2. A Unified National Program For Floodplain Management, Federal Interagency Floodplain Management Task Force, 1994.

3. Flood Hazard Information, Highball and Risky Creeks, Floodville, Colorado, U.S. Army Corps of Engineers, Omaha District, 1981.

4. Floodville Daily Record, July 4, 1888.

5. Flood Hazard Mitigation Planning Manual, Northeastern Illinois Planning Commission, 1995.